

Cisco 10GBASE Dense Wavelength-Division Multiplexing SFP+ Modules

Use Dense Wavelength-Division Multiplexing (DWDM) SFP+ modules to integrate WDM transport directly into your Cisco 10 Gigabit Ethernet switches and routers.

Product Overview

The Cisco 10GBASE DWDM SFP+ Modules (Figure 1) are fiber line cards for a wide variety of Cisco switches, routers, and other equipment. They allow enterprises and service providers to provide scalable and easy-to-deploy 10-Gbps LAN, WAN, and optical transport network (OTN) services in their networks.

Figure 1. Cisco DWDM SFP+ Module



Features and Benefits

The Cisco 10GBASE Dense Wavelength-Division Multiplexing SFP+ Module offer the following features and benefits:

- Supports 10-Gigabit data rates from 9.9G to 11.1G (LAN, WAN, and OTU2/OTU2e) to accommodate different applications
- Smallest SFP+ module footprint in the industry
- Hot-swappable input/output device plugs into an Ethernet SFP+ port of a Cisco switch or router to link the port with the network
- Support for a “pay-as-you-grow” model for investment protection
- Digital optical monitoring capability for enhanced diagnostics and troubleshooting
- DWDM fixed module supports 40 non-tunable ITU 100-GHz wavelengths
- DWDM tunable module supports 96 tunable ITU 50-GHz wavelengths
- Supports the Cisco quality identification (ID) feature, which enables a Cisco switch or router to identify whether or not the module is an SFP+ module certified and tested by Cisco

Platform Support

The Cisco DWDM SFP+ modules are supported across a variety of Cisco switches, routers, and optical transport devices. For more details, refer to the Cisco 10-Gigabit transceivers compatibility matrix at http://www.cisco.com/en/US/docs/interfaces_modules/transceiver_modules/compatibility/matrix/OL_6974.pdf.

Connectors and Cabling

- Equipment: standard SFP+ interface
- Network: dual LC/PC connector

Note: Only connections with patch cords with PC or UPC connectors are supported. Patch cords with APC connectors are not supported. All cables and cable assemblies used must be compliant with the standards specified in the standards section.

Product Specifications

Optical Parameters

Table 1 shows the main optical characteristics for the standard non-tunable Cisco DWDM SFP+ modules.

Table 1. Optical Parameters for DWDM SFP+

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and Conditions
Transmitter						
Spectral width				0.2	nm	Full width, -20 dB from maximum, with resolution bandwidth (RBW) = 0.01 nm
Transmitter center wavelength		x - 100	x	x + 100	Pm	Refer to Table 2 for center wavelengths
Side-mode suppression ratio	SMSR	30			dB	
Transmitter extinction ratio		9			dB	
Transmitter optical output power	Pout	-1.0		3.0	dBm	Average power coupled into single-mode fiber
Receiver						
Receiver optical input wavelength		1530		1565	nm	
Receiver damage threshold		4.0			dBm	
Receiver overload		-7			dBm	
Receiver Power Performance						
			Units	Range	Notes and Conditions	
Performance at 10G LAN and 10G WAN Rates (NO-FEC Applications)						
Input power range			dBm	-7 to -23	At BER=1E-12, back-to-back, unamplified link	
Input power range (dispersion-limited)			dBm	-7 to -20	At BER=1E-12, -500 to +1600 ps/nm chromatic dispersion [*] , unamplified link	
Input power range (dispersion- and noise-limited)			dBm	-7 to -17	At BER=1E-12, -500 to +1600 ps/nm chromatic dispersion [*] , amplified link with min 27dB OSNR (0.1nm RBW)	

Performance at OTU2/OTU2e rates (FEC applications)				
Input power range	dBm	-7 to -27	At BER=1E-3 (pre-EFEC), back-to-back, unamplified link	
Input power range (dispersion-limited)	dBm	-7 to -24	At BER=1E-3 (pre-EFEC), -500 to +1300 ps/nm chromatic dispersion, unamplified link	
Input power range (dispersion- and noise-limited)	dBm	-7 to -17	At BER=1E-3 (pre-EFEC), -500 to +1100 ps/nm chromatic dispersion, amplified link with min 16dB OSNR (0.1nm RBW)	
Input power range (dispersion- and noise-limited)	dBm	-7 to -17	At BER=1E-5 (pre-GFEC), -500 to +1100 ps/nm chromatic dispersion, amplified link with min 19dB OSNR (0.1nm RBW)	

* Up to 1600ps/nm chromatic dispersion is supported for fiber links between two Cisco DWDM SFP+ modules. For connections between a Cisco DWDM SFP+ module and a Cisco DWDM XENPAK, X2 or XFP module, limit chromatic dispersion to 1300ps/nm.

Table 2 shows the main optical characteristics for the tunable Cisco DWDM SFP+ modules.

Table 2. Optical Parameters for Tunable DWDM SFP+

Parameter	Symbol	Minimum	Typical	Maximum	Units	Notes and Conditions
Transmitter						
Spectral width				0.2	nm	Full width, -20 dB from maximum, with resolution bandwidth (RBW) = 0.01 nm
Transmitter center wavelength		x - 25	x	x + 25	pm	Refer to Table 3 for center wavelengths
Side-mode suppression ratio	SMSR	30			dB	
Transmitter extinction ratio		9			dB	
Transmitter optical output power	Pout	-1		3.0	dBm	Average power coupled into single-mode fiber
Receiver						
Receiver optical input wavelength		1525		1570	nm	
Receiver damage threshold		4.0			dBm	
Receiver overload		-7.0			dBm	
Receiver Power Performance						
			Units	Range	Notes and Conditions	
Performance at 10G LAN and 10G WAN Rates (NO-FEC Applications)						
Input power range	dBm	-7 to -23	At BER=1E-12, back-to-back, unamplified link			
Input power range (dispersion-limited)	dBm	-7 to -20	At BER=1E-12, -500 to 1600 ps/nm chromatic dispersion, unamplified link			
Input power range (dispersion- and noise-limited)	dBm	-7 to -18	At BER=1E-12, -500 to 1600 ps/nm chromatic dispersion, amplified link with min 26dB OSNR (0.1nm RBW)			
Performance at OTU2/OTU2e Rates (FEC Applications)						
Input power range	dBm	-7 to -27	At BER=1E-3 (pre-EFEC), back-to-back, unamplified link			
Input power range (dispersion-limited)	dBm	-7 to -24	At BER=1E-3 (pre-EFEC), -500 to 1300 ps/nm chromatic dispersion, unamplified link			
Input power range (dispersion- and noise-limited)	dBm	-7 to -18	At BER=1E-3 (pre-EFEC), -500 to 1100 ps/nm chromatic dispersion, amplified link with min 14.5dB OSNR (0.1nm RBW)			
Input power range (dispersion- and noise-limited)	dBm	-7 to -18	At BER=1E-5 (pre-GFEC), -500 to 1100 ps/nm chromatic dispersion, amplified link with min 17dB OSNR (0.1nm RBW)			

Note:

1. Parameters are specified over temperature and at end of life unless otherwise noted.
2. When shorter distances of single-mode fiber are used, an inline optical attenuator must be used to avoid overloading and damaging the receiver.

Table 3 shows the 96 DWDM ITU-50GHz channels to which the device can be tuned.

Table 3. ITU 50-GHz Center Wavelengths and Channel Numbering

Channel ID	Frequency (THz)	Wavelength (nm)	Channel ID	Frequency (THz)	Wavelength (nm)
1	191.35	1566.72	49	193.75	1547.32
2	191.4	1566.31	50	193.8	1546.92
3	191.45	1565.90	51	193.85	1546.52
4	191.5	1565.50	52	193.9	1546.12
5	191.55	1565.09	53	193.95	1545.72
6	191.6	1564.68	54	194	1545.32
7	191.65	1564.27	55	194.05	1544.92
8	191.7	1563.86	56	194.1	1544.53
9	191.75	1563.45	57	194.15	1544.13
10	191.8	1563.05	58	194.2	1543.73
11	191.85	1562.64	59	194.25	1543.33
12	191.9	1562.23	60	194.3	1542.94
13	191.95	1561.83	61	194.35	1542.54
14	192	1561.42	62	194.4	1542.14
15	192.05	1561.01	63	194.45	1541.75
16	192.1	1560.61	64	194.5	1541.35
17	192.15	1560.20	65	194.55	1540.95
18	192.2	1559.79	66	194.6	1540.56
19	192.25	1559.39	67	194.65	1540.16
20	192.3	1558.98	68	194.7	1539.77
21	192.35	1558.58	69	194.75	1539.37
22	192.4	1558.17	70	194.8	1538.98
23	192.45	1557.77	71	194.85	1538.58
24	192.5	1557.36	72	194.9	1538.19
25	192.55	1556.96	73	194.95	1537.79
26	192.6	1556.55	74	195	1537.40
27	192.65	1556.15	75	195.05	1537.00
28	192.7	1555.75	76	195.1	1536.61
29	192.75	1555.34	77	195.15	1536.22
30	192.8	1554.94	78	195.2	1535.82
31	192.85	1554.54	79	195.25	1535.43
32	192.9	1554.13	80	195.3	1535.04
33	192.95	1553.73	81	195.35	1534.64
34	193	1553.33	82	195.4	1534.25
35	193.05	1552.93	83	195.45	1533.86
36	193.1	1552.52	84	195.5	1533.47

Channel ID	Frequency (THz)	Wavelength (nm)	Channel ID	Frequency (THz)	Wavelength (nm)
37	193.15	1552.12	85	195.55	1533.07
38	193.2	1551.72	86	195.6	1532.68
39	193.25	1551.32	87	195.65	1532.29
40	193.3	1550.92	88	195.7	1531.90
41	193.35	1550.52	89	195.75	1531.51
42	193.4	1550.12	90	195.8	1531.12
43	193.45	1549.72	91	195.85	1530.72
44	193.5	1549.32	92	195.9	1530.33
45	193.55	1548.91	93	195.95	1529.94
46	193.6	1548.51	94	196	1529.55
47	193.65	1548.11	95	196.05	1529.16
48	193.7	1547.72	96	196.1	1528.77

Dimensions

Dimensions (H x W x D): 8.5 x 13.4 x 56.5mm. Cisco SFP+ modules typically weigh 75 grams or less.

Environmental Conditions and Power Requirements

- Commercial operational temperature range (COM): 0 to 70°C (32 to 158°F)
- Storage temperature range: -40 to 85°C (-40 to 185°F)
- The maximum power consumption per Cisco SFP+ module is 1.5W

Regulatory and Standards Compliance Standards

- GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable
- GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
- GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors
- SFP+ MSA SFF-8431
- IEEE 802.3: 10-Gigabit Ethernet
- ITU-T G.709: Interfaces for the Optical Transport Network
- ITU-T G.975: GFEC
- ITU-T G.975.1: EFEC
- ITU-T G.694.1: DWDM frequency grid Safety
- Laser Class 1 (21CFR1040 and IEC 60825)

Warranty

- Standard warranty: 1 year
- Extended warranty (optional): Cisco SFP+ modules can be covered in a Cisco SMARTnet® Service support contract for the Cisco switch or router chassis

Ordering Information

Table 4 provides the ordering information for Cisco SFP+ modules and related cables.

Table 4. Cisco DWDM SFP+ Ordering Information

Product Number	Description	ITU Channel
DWDM-SFP10G-61.41=	10GBASE-DWDM 1561.41 nm SFP+ (100-GHz ITU grid)	20
DWDM-SFP10G-60.61=	10GBASE-DWDM 1560.61 nm SFP+ (100-GHz ITU grid)	21
DWDM-SFP10G-59.79=	10GBASE-DWDM 1559.79 nm SFP+ (100-GHz ITU grid)	22
DWDM-SFP10G-58.98=	10GBASE-DWDM 1558.98 nm SFP+ (100-GHz ITU grid)	23
DWDM-SFP10G-58.17=	10GBASE-DWDM 1558.17 nm SFP+ (100-GHz ITU grid)	24
DWDM-SFP10G-57.36=	10GBASE-DWDM 1557.36 nm SFP+ (100-GHz ITU grid)	25
DWDM-SFP10G-56.55=	10GBASE-DWDM 1556.55 nm SFP+ (100-GHz ITU grid)	26
DWDM-SFP10G-55.75=	10GBASE-DWDM 1555.75 nm SFP+ (100-GHz ITU grid)	27
DWDM-SFP10G-54.94=	10GBASE-DWDM 1554.94 nm SFP+ (100-GHz ITU grid)	28
DWDM-SFP10G-54.13=	10GBASE-DWDM 1554.13 nm SFP+ (100-GHz ITU grid)	29
DWDM-SFP10G-53.33=	10GBASE-DWDM 1553.33 nm SFP+ (100-GHz ITU grid)	30
DWDM-SFP10G-52.52=	10GBASE-DWDM 1552.52 nm SFP+ (100-GHz ITU grid)	31
DWDM-SFP10G-51.72=	10GBASE-DWDM 1551.72 nm SFP+ (100-GHz ITU grid)	32
DWDM-SFP10G-50.92=	10GBASE-DWDM 1550.92 nm SFP+ (100-GHz ITU grid)	33
DWDM-SFP10G-50.12=	10GBASE-DWDM 1550.12 nm SFP+ (100-GHz ITU grid)	34
DWDM-SFP10G-49.32=	10GBASE-DWDM 1549.32 nm SFP+ (100-GHz ITU grid)	35
DWDM-SFP10G-48.51=	10GBASE-DWDM 1548.51 nm SFP+ (100-GHz ITU grid)	36
DWDM-SFP10G-47.72=	10GBASE-DWDM 1547.72 nm SFP+ (100-GHz ITU grid)	37
DWDM-SFP10G-46.92=	10GBASE-DWDM 1546.92 nm SFP+ (100-GHz ITU grid)	38
DWDM-SFP10G-46.12=	10GBASE-DWDM 1546.12 nm SFP+ (100-GHz ITU grid)	39
DWDM-SFP10G-45.32=	10GBASE-DWDM 1545.32 nm SFP+ (100-GHz ITU grid)	40
DWDM-SFP10G-44.53=	10GBASE-DWDM 1544.53 nm SFP+ (100-GHz ITU grid)	41
DWDM-SFP10G-43.73=	10GBASE-DWDM 1543.73 nm SFP+ (100-GHz ITU grid)	42
DWDM-SFP10G-42.94=	10GBASE-DWDM 1542.94 nm SFP+ (100-GHz ITU grid)	43
DWDM-SFP10G-42.14=	10GBASE-DWDM 1542.14 nm SFP+ (100-GHz ITU grid)	44
DWDM-SFP10G-41.35=	10GBASE-DWDM 1541.35 nm SFP+ (100-GHz ITU grid)	45
DWDM-SFP10G-40.56=	10GBASE-DWDM 1540.56 nm SFP+ (100-GHz ITU grid)	46
DWDM-SFP10G-39.77=	10GBASE-DWDM 1539.77 nm SFP+ (100-GHz ITU grid)	47
DWDM-SFP10G-38.98=	10GBASE-DWDM 1538.98 nm SFP+ (100-GHz ITU grid)	48
DWDM-SFP10G-38.19=	10GBASE-DWDM 1538.19 nm SFP+ (100-GHz ITU grid)	49
DWDM-SFP10G-37.40=	10GBASE-DWDM 1537.40 nm SFP+ (100-GHz ITU grid)	50
DWDM-SFP10G-36.61=	10GBASE-DWDM 1536.61 nm SFP+ (100-GHz ITU grid)	51
DWDM-SFP10G-35.82=	10GBASE-DWDM 1535.82 nm SFP+ (100-GHz ITU grid)	52
DWDM-SFP10G-35.04=	10GBASE-DWDM 1535.04 nm SFP+ (100-GHz ITU grid)	53
DWDM-SFP10G-34.25=	10GBASE-DWDM 1534.25 nm SFP+ (100-GHz ITU grid)	54
DWDM-SFP10G-33.47=	10GBASE-DWDM 1533.47 nm SFP+ (100-GHz ITU grid)	55

Product Number	Description	ITU Channel
DWDM-SFP10G-32.68=	10GBASE-DWDM 1532.68 nm SFP+ (100-GHz ITU grid)	56
DWDM-SFP10G-31.90=	10GBASE-DWDM 1531.90 nm SFP+ (100-GHz ITU grid)	57
DWDM-SFP10G-31.12=	10GBASE-DWDM 1531.12 nm SFP+ (100-GHz ITU grid)	58
DWDM-SFP10G-30.33=	10GBASE-DWDM 1530.33 nm SFP+ (100-GHz ITU grid)	59
DWDM-SFP10G-C	10GBASE-DWDM tunable SFP+ (50-GHz ITU grid)	See Table 3

Next Steps

Learn more about Cisco 10GBASE DWDM SFP+ modules by contacting your Cisco sales representative.



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